MINERALOGY OF THE INVERTED CHANNEL ON THE FLOOR OF MIYAMOTO CRATER, MARS.
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Introduction: Miyamoto crater is a 160-km-diameter impact crater of Noachian age located southwest of Meridiani Planum whose north and north-eastern half is buried beneath light-toned layered rock, overlain by a thin regolith of sand, granules, and hematitic spherules [1]. The regional geologic history of the Meridiani Planum region has been extensively studied [2-6] and is interpreted to have begun with formation of the ancient cratered crust and a subsequent major fluvial episode carved an extensive valley network, originating from an area located south of the Schiaparelli impact basin [5].

The north-eastern portion of the crater is buried by a plain forming unit composed of layered sedimentary rock covered with a thin sand sheet. The extent of the plains unit corresponds with occurrences of crystalline gray hematite [7] which hosts the landing site of the MER Opportunity rover [8]. Previous studies have shown that the surface of the plains unit is dominated spectrally by basaltic sand, gray hematite, and nanophase iron oxides [9] with outcrops of sulfate-rich evaporites [10,11]. The western portion of the Miyamoto crater floor may have been exposed by aeolian erosion [2] and has been interpreted as predating the formation of the sulfate- and hematite-bearing plains unit. In this region extensive deposits of Fe/Mg-smectites have been identified suggesting a transition from neutral pH to a more acidic pH through time [2].

The western floor of the Miyamoto crater contains morphological features that are suggestive of past fluvial activity and the presence of water. Among them a raised curvilinear feature has been interpreted as a sinuous, narrow inverted paleochannel deposit ~25 km in length and 30-50 m height [1].

Because of these characteristics the western floor of the Miyamoto crater was proposed as a candidate landing site for the upcoming Mars Science Laboratory (MSL) rover [12].

Here we present the analysis of the most recent high-resolution (~20 m/pixel) observation by CRISM [13] with emphasis on the hydrated mineral identification and their location. This new observation is centered on the inverted channel (3.0S, 352.1E) and has been analyzed for the first time.

Analysis and results: CRISM observation FRT0000C71F (Fig. 1, top panel) is centered on the inverted channel and offers a unique opportunity to further investigate the mineralogical characteristics of this features and its surroundings.

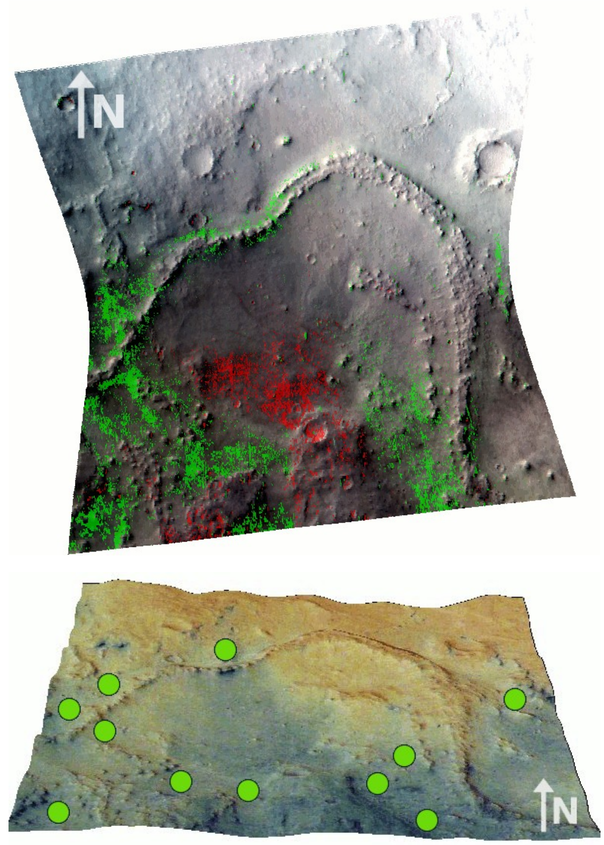

Figure 1. Top panel: CRISM FRT0000C71F in false RGB color. R = 2.3 µm, G = 1.5 µm, B = 1.1 µm. Superimposed green and red colors represent high D2300 values, corresponding to phyllosilicate occurrence and the spectrally bland area, respectively. Bottom panel: HRSC digital terrain model at 75 m/pixel of the inverted channel. Colors are consistent with HRSC 'Mars-like' calibration (HRSC view).Green dots indicate the approximate locations of Fe/Mg-smectites.

CRISM measures reflected energy from the surface that provides the ability to recognize primary and secondary minerals [13]. CRISM data have been converted to apparent I/F (the ratio of reflected to incident sunlight), then divided by the cosine of the incidence angle to correct for the illumination geometry. The atmospheric contribution has been removed using a new 'volcano scan' technique correction proposed by McGuire et al. [14], which considers two spectral bands at 1.980 µm and 2.007 µm instead of the usual 1.890 µm and 2.011 µm [13,15]. This choice enables rapider and more-thorough analyses of surface hydration and surface H_2O ice.

The phyllosilicate deposits have been mapped, following the approach of [2], based on the presence of the 2.3 µm spectral absorption feature using the D2300 parameter index [16]. Values of D2300 > 0.008 are shown as green in figure 1 and represent the potential location of phyllosilicates.

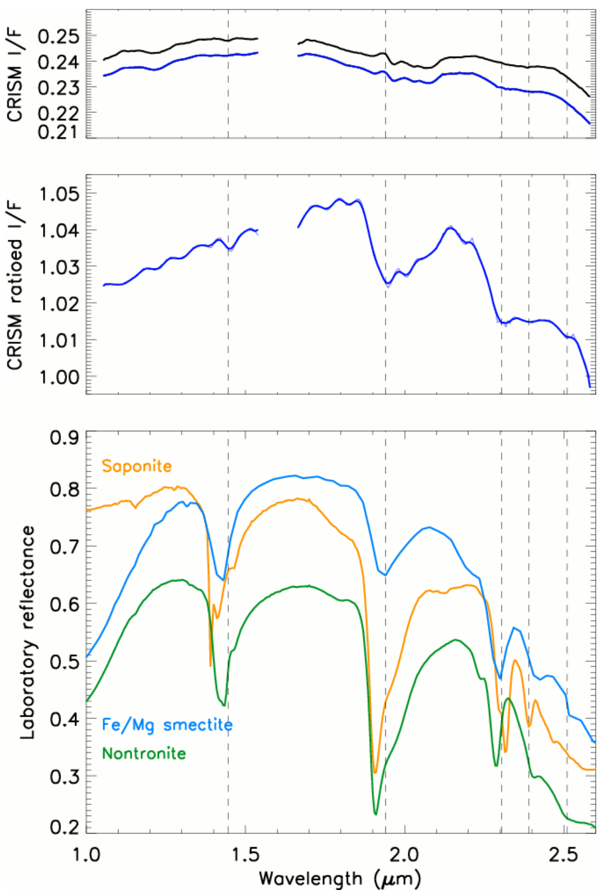

Figure 2. The top panel shows the average spectrum (blue) retrieved from the CRISM observation corresponding to high values of the D2300 parameter (see text) and a spectrally bland spectrum (black). Their ratio is reported in the mid panel. The bottom panel shows laboratory spectra of selected minerals.

The average I/F corresponding to values of D2300 > 0.008 is shown in figure 2 (blue, top panel), along with its ratio (blue, middle panel) to a spectrally bland region (black, top panel). The spectrally bland region is shown as red in figure 1. The 1.9 µm and the 2.3 µm bands are clearly visible, and their positions appear to be consistent with Fe/Mg-smectite, as already suggested for this area [2].

Bottom panel of figure 1 shows a vertical exaggerated (8x) digital terrain model from Mex/HRSC [17] and locations (green dots) of the Fe/Mg-smectite. Phyllosilicates occur in low elevation areas and around the inverted channel. In general they appear anti-correlated with the inverted channel. The spectral signature of the cap layer of the inverted channel is similar to that of the surrounding material. This is consistent with the interpretation that this capping layer is covered by surficial materials [1].

Conclusions: We have analyzed a new CRISM observation centered on a curvilinear feature in Miyamoto crater, previously interpreted as an inverted paleochannel deposit [1]. The inverted channel appears to be located in an area rich in Fe/Mg-smectite which are uniquely associated with the lowest terrain in the area. Given previous stratigraphic interpretation [2] this suggests that the phyllosilicates are ancient deposits exhumed by erosion [1,2]. The close association of the phyllosillicate signature and the overlying inverted channel feature provide additional supporting evidence that this area on the floor of the Miyamoto crater experienced aqueous and fluvial activity suggestive of a habitable environment.

Until recently the site was under consideration for the Mars Science Laboratory landing site, and remains a potentially interesting location for future in situ study.

References: [1] Newsom H. E. et al. (2009) *Icarus*, in press. [2] Wiseman S. M. et al. (2008) *GRL*, *35*, L19204. [3] Hynek B. M. et al. (2002) *JGR*, *107*, E10, 5088. [4] Arvidson R. E. et al. (2003) *JGR*, *108*, E12, 8073. [5] Newsom H. E. et al. (2003) *JGR*, *108*, E12. [6] Hynek B. M. and Phillips R. J. (2008) *EPSL*, *274*, 214-220. [7] Christensen P. R. et al. (2001) *JGR*, *105*, E4, 9623-9642. [8] Squyres S. W. et al. (2006) *JGR*, *111*, E12S12. [9] Ardvison R. E. et al. (2006) *JGR*, *111*, E12S08. [10] Grotzinger J. P. et al. (2005) *EPSL*, *240*, 11-72. [11] Morris R. V. et al. (2006) *JGR*, *111*, E12S15. [12] Vasavada A. R. et al. (2007) *Seventh International Conference on Mars*, Abstract #3031. [13] Murchie, S. et al. (2007) *JGR*, *112*, E12S15. [14] McGuire et al. (2009) in preparation. [15] Erard S. and Calvin W. (1997) *Icarus*, *130*, 449-460. [16] Pelkey S. M. et al. (2007) *JGR*, *112*, E08S14. [17] Jaumann R. et al. (2007) *PSS*, *55*, 7-8, 928-952.